

## Claims

1. A device for optical coupling comprising

first and second optical waveguides (13, 23) extending longitudinally  
with cores (14, 24) adapted to guide optical radiation (15),

first resonator means, laterally surrounding the first waveguide, comprising first and second resonator members (18, 19), and second resonator means, laterally surrounding the second waveguide, comprising third and fourth resonator members (28, 29),

**characterised in that**

first and second deflector means (16, 26), adapted to couple radiation propagating in the respective first and second waveguides with common radiation modes (30), which modes are defined by adjustable geometrical and material properties of the device, so as to obtain wavelength selective coupling of radiation guided by the first and second waveguides, provided the resonator means are tuned to the same resonance wavelength.

2. A device for optical coupling according to claim 1, **characterised in that**

at least one of the waveguides comprise optical fibers or planar optical waveguides.

3. A device for optical coupling according to claim 1, **characterised in that**

at least one of the deflector means includes a periodic refractive index modulation grating, preferably inscribed in the light-guiding regions of said optical waveguide.

4. A device for optical coupling according to claim 3, **characterised in that**

the deflector means includes optical Bragg grating, preferably tilted.

5. A device for optical coupling according to claim 1, **characterised in that**  
comprised optical elements, such as the resonator means, the optical  
waveguides and the deflector means are arranged to have mirror symmetry with  
respect to a plane defined by the longitudinal and transverse optical axes (1, 2).
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6. A device for optical coupling according to any of preceding claims, **character-**  
**ised in that**  
at least one of the resonator members is a mirror chosen from a group  
consisting of: dielectric multilayer mirror, metal mirror and metal mirror with di-  
electric coating.
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7. A device for optical coupling according to claim 1, **characterised in that**  
a separation between the first second resonator means provides an in-  
ternal resonator means, and  
the separation is selected to locate the internal resonator resonance at  
wavelengths outside the range in which the resonator means are made resonant.
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8. A device for optical coupling according to claim 1, **characterised in that**  
the resonance wavelength of each of the resonator means is controllable  
by adjusting the optical distance, i.e. the product of the geometrical distance and  
refractive index, between the first and second resonator members and the third  
and fourth resonator members, respectively.
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9. A device for optical coupling according to claim 1, **characterised in that**  
the resonator means are made resonant to radiation having a wavelength  
within the range of 1,260 to 1,675  $\mu\text{m}$ .
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10. A device for optical coupling according to claim 1, **characterised in that**  
the resonator means are made resonant to radiation having a wavelength  
within anyone of the ranges of: 1,260 to 1,360  $\mu\text{m}$  (O-band), 1,360 to 1,460  $\mu\text{m}$
- 30

(E-band), 1,460 to 1,530  $\mu\text{m}$  (S-band), 1,530 to 1,565  $\mu\text{m}$  (C-band), 1,565 to 1,625  $\mu\text{m}$  (L-band) or 1,625 to 1,675  $\mu\text{m}$  (U-band).

11. A device for optical coupling according to claim 3 or 4, **characterised in that**  
5                   the respective deflector means include two superposed Bragg gratings,  
                  having essentially orthogonal grating vectors.

12. A device for optical coupling according to claim 11, **characterised in that**  
                  the superposed gratings are adapted to deflect light in the same longitu-  
10               dinal direction but in opposite transverse directions and simultaneously collect  
                  light arriving from the same longitudinal direction but from opposite transverse  
                  directions.

13. A device for optical coupling according to claim 3, **characterised in that**  
15                   the deflector means includes transversally asymmetric optical Bragg  
                  grating.

14. A device for optical coupling according to claim 1, **characterised in that**  
                  at least one of the deflector means includes a grating comprising blazed  
20               corrugations having alternating projections and spaces along a wall parallel to  
                  the longitudinal axis of the respective waveguides.

15. A device for optical coupling according claim 11, **characterised in that**  
                  interference between waves coupled out from each of the gratings is  
25               controllable by adjusting the geometrical position or refractive index of any of  
                  the waveguides the resonator means.

16. A device for optical coupling according to anyone of claims 8 or 15, **character-**  
                  **ised in that**  
30                   the refractive index is controllable by adjusting at least one parameter

chosen from a group consisting of : temperature, injection of charge carriers, application of an electric voltage and application of mechanical stress.

17. A device for optical coupling according to anyone of preceding claims, **characterised in that**

the spectral selectivity is controllable by changing mirror separation along the longitudinal optical axis for the first and second resonator means, or by having a chirped grating period in the first and second deflector means.

18. A device for optical coupling according to claim 1, **characterised in that**

beam transformation means is arranged between the resonator means to reduce transverse beam divergence, whereby the means is chosen from a group comprising: a conventional, preferably cylindrical, lens, a Fresnel lens, a refractive or diffractive optical element.

19. A device for optical coupling according to claim 1, **characterised in that**

each of the first and said second resonator means has different optical thickness, while being resonant for the same wavelength.

20. A device for optical coupling according to claim 1, **characterised in that**

the orders of resonance of at least one of the resonator means is adjustable so as to tune the coupling wavelength.

21. An array of devices for optical coupling according to anyone of preceding claims,

**characterised in that**

each device for optical coupling is adapted to couple any wavelength within a predetermined wavelength range.

22. A method of fabricating a device for optical coupling according to anyone of preceding claims,

**characterised by**

sandwiching two essentially identical structures, each including an external resonator and an optical waveguide with a deflector.

23. Use of a device for optical coupling according to anyone of claims 1-20 as a two-port spectrally tunable transmission filter.

24. Use of a device for optical coupling according to anyone of claims 1-20 as a two-port spectrally selective attenuator.